AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (Currently Amended) A method for controlling a crane drive unit so as to suppress sway of a load suspended by a rope of a crane, which sway occurs when the load has been transported from a first position to a second position, the control being made by operating a controller having a filter unit by using a feedforward control program, comprising:

removing a component near a resonance frequency by the filter unit from a transportation command for the load, in which command a maximum value among at least one of a transportation speed, transportation acceleration, and transportation jerk is limited, under the resonance frequency sequentially computed from a rope length that is a distance from the center of rotation of the sway of the rope to the center of gravity of the load and under parameters that relate to a control unit of the crane drive unit and that are previously computed so as not to exceed a performance of the crane drive unit; [[and]]

wherein based on expression (1) or (2), the component near the resonance frequency is removed by using parameters a_i (f) and b_i (f), which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

<u>where a_i (f) and b_j (f) are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and</u>

<u>Expression (2)</u>

$$F(S) = \frac{Y(S)}{X(S)} = \frac{b_0(f)S^0 + b_1(f)S^1 + b_2(f)S^2 + \cdots}{a_0(f)S^0 + a_1(f)S^1 + a_2(f)S^2 + \cdots} = \frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

<u>where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator, and</u>

inputting the transportation command from which the component near the resonance frequency is removed into the crane drive unit, thereby controlling the crane drive unit so that the load does not greatly sway when the load is transported from the first position to the second position.

2. (Currently Amended) A system for controlling a crane drive unit so as to suppress sway of a load suspended by a rope of a crane, which sway occurs when the load has been transported from a first position to a second position, the control being made by operating a controller having a filter unit by using a feedforward control program, comprising:

a rope length detection unit for detecting a rope length that is a distance from the center of rotation of the sway of the rope to the center of gravity of the load;

a resonance frequency computing unit for computing a resonance frequency of the rope having said rope length;

a transportation command transmitting unit for transmitting a transportation command for the load given by a transportation command applicator;

a parameter computing unit for previously computing parameters for a control unit of the crane drive unit so that the parameters do not exceed a performance of the crane drive unit;

a parameter storing unit for receiving and storing the parameters from the parameter computing unit;

a maximum value limiting unit for limiting a maximum value among at least one of a transportation speed, transportation acceleration, and transportation jerk in the transportation command for the load from the transportation command transmitting unit under the parameters from the parameter storing unit; and

a filter unit for receiving the resonance frequency from the resonance frequency calculating unit, the filter unit removing a component near the resonance frequency from the transportation command in which the maximum value is limited by the maximum value limiting unit, under the parameters from the parameter storing unit, the filter unit inputting in the crane drive unit the transportation command from which the component near the resonance frequency is removed**[[.]]**,

wherein based on expression (1) or (2), the component near the resonance frequency is removed by using parameters a_i (f) and b_i (f), which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where a_i (f) and b_j (f) are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S) = \frac{Y(S)}{X(S)} = \frac{b_0(f)S^0 + b_1(f)S^1 + b_2(f)S^2 + \cdots}{a_0(f)S^0 + a_1(f)S^1 + a_2(f)S^2 + \cdots} = \frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.

3. (Currently Amended) A medium in which a feedforward control program is stored, the feedforward control program controlling a crane drive unit by a controller having a filter unit so as to suppress sway of a load suspended by a rope of a crane, which sway occurs when the load has been transported from a first position to a second position, the feedforward control program being programmed to cause the filter unit of the controller to remove a component near a resonance frequency from a transportation command for the load, in which command a maximum value among at least one of a transportation speed, transportation acceleration, and transportation jerk is limited, under the resonance frequency sequentially computed from a rope length that is a distance from the center of rotation of the sway of the rope to the center of gravity of the load and under parameters for a control unit of the crane drive unit, which parameters are previously computed so as not to exceed a performance of the crane drive unit, the feedforward control program being also programmed to cause the filter unit to input the

transportation command from which the component near the resonance frequency is removed in the crane drive unit[[.]],

wherein based on expression (1) or (2), the component near the resonance frequency is removed by using parameters $a_i (f)$ and $b_j (f)$, which are determined by computing them in a simulation in which a model expressing the characteristic of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdot\cdot\cdot - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdot\cdot\cdot$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where $a_i (f)$ and $b_j (f)$ are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S) = \frac{Y(S)}{X(S)} = \frac{b_0(f)S^0 + b_1(f)S^1 + b_2(f)S^2 + \cdot\cdot\cdot}{a_0(f)S^0 + a_1(f)S^1 + a_2(f)S^2 + \cdot\cdot\cdot} = \frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.

4. (Currently Amended) A crane having a turning motor for turning a crane boom, a turning motor control unit for controlling a speed and a direction of rotation of the turning motor, a rolling-up motor for rolling a rope of the crane up and down, and a

rolling-up motor control unit for controlling a speed and a direction of rotation of the rolling-up motor, further comprising:

a rope length detection unit for detecting a present length of a rope of the crane; and

a controller electrically coupled to both the turning motor control unit and the rolling-up motor control unit, the controller outputting to the turning motor control unit a signal transformed from a signal of the rope length by a feedforward control to drive the turning motor based on the transformed signal from which the component near the resonance frequency is removed so as to suppress sway of a load suspended from the rope at a moment when the load has been transported from a first position to a second position[[.]],

wherein based on expression (1) or (2), the component near the resonance frequency is removed by using parameters a_i (f) and b_j (f), which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where a_i (f) and b_j (f) are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S)=\frac{Y(S)}{X(S)}=\frac{b_0(f)S^0+b_1(f)S^1+b_2(f)S^2+\cdots}{a_0(f)S^0+a_1(f)S^1+a_2(f)S^2+\cdots}=\frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.

5. (Original) The crane of claim 4, further comprising a boom-hoisting motor for hoisting the crane boom and a boom-hoisting motor control unit for controlling a speed and a direction of rotation of the boom-hoisting motor, wherein the boom-hoisting motor control unit is electrically coupled to the controller, and the controller further outputs to the boom-hoisting motor control unit the signal transformed from the signal of the rope length by the feedforward control so as to suppress the sway of the load suspended from the rope at the moment when the load has been transported from the first position to the second position.

6. (Original) The crane of claim 4 or 5, wherein the controller is attachable to an existing crane.

7. (Currently Amended) A controller for a crane attachable to an existing crane that includes a turning motor for turning a boom of the crane, a boom-hoisting motor for hoisting the boom, a turning motor control unit for controlling a speed and a direction of rotation of the turning motor, and a boom-hoisting motor control unit for controlling a speed and a direction of rotation of the boom-hoisting motor, wherein only a signal of a rope length of the crane is inputable to the controller, and wherein the controller outputs a signal transformed from the signal of the rope length by a feedforward control to drive the turning motor and the boom-hoisting motor based on the transformed signal from

which the component near the resonance frequency is removed, so as to suppress sway of a load suspended from a rope of the crane at a moment when the load has been transported from a first position to a second position under a condition that there is no disturbance[[.]],

wherein based on expression (1) or (2), the component near the resonance frequency is removed by using parameters a_i (f) and b_j (f), which are determined by computing them in a simulation in which a model expressing the characteristics of the crane is used, while changing their values little by little, and which values are stored,

Expression (1)

$$y(t) = b_0(f)x(t) + b_1(f)x(t-1) + b_2(f)x(t-2) + \cdots - a_1(f)y(t-1) - a_2(f)y(t-2) - \cdots$$

$$y(t) = \sum_{j=0}^{m} b_j(f)x(t-j) - \sum_{i=1}^{n} a_i(f)y(t-i)$$

where a_i (f) and b_j (f) are parameters mediated by the resonance frequency f sequentially computed for the varying length of the rope, and

Expression (2)

$$F(S) = \frac{Y(S)}{X(S)} = \frac{b_0(f)S^0 + b_1(f)S^1 + b_2(f)S^2 + \cdots}{a_0(f)S^0 + a_1(f)S^1 + a_2(f)S^2 + \cdots} = \frac{\sum_{j=0}^{m} b_j(f)S^j}{\sum_{i=0}^{n} a_i(f)S^i}$$

where expression (1) is obtained by carrying out a Z-transformation to the transfer function of the filter shown in expression (2), and S is a Laplacian operator.